Thinking Outside the Box: Macroeconomic and Inland Network Impacts on Port Competitiveness

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1 Executive Summary

Conventional wisdom regarding North American West Coast container traffic holds that container traffic is highly sensitive to cost differentials among ports. The primary source of this belief is a series of studies undertaken by Leachman and Associates for the Southern California Association of Governments (SCAG)[1] and for the Washington State Joint Transportation Committee,[2] which modelled port choice based on relative transportation and inventory costs for various port routing options. The extent to which this view has been embraced by port stakeholders is illustrated by the conclusion of the recent FMC report on cargo diversion that up to 1.9 million TEU's of current US port traffic is vulnerable to diversion, in spite of evidence that recent volumes of traffic diverted to Canadian and Mexican ports remain below historical levels.

This paper analyzes the market performance of two West Coast port complexes – Vancouver BC and the Southern California ports of Los Angeles and Long Beach – based on macroeconomic factors and the competitiveness of inland transportation networks to derive alternative estimates of price elasticity for West Coast container traffic. In both cases the results suggest that traffic is much less sensitive to relative cost differentials than conventional wisdom suggests.

The Port of Vancouver's share of West Coast container traffic increased from 9% in 2002 to 11% in 2011. Conventional wisdom suggests this implies declining costs relative to competing US ports. However, this occurred over a period in which the Canadian dollar appreciated by almost 36% relative to the US dollar, with a consequent increase in inland transportation costs relative to US routings. This anomaly is explored in this paper by analyzing the impact of exchange rates on relative intermodal rail costs and on Canadian demand for imports from Pacific Rim countries. The results suggest that the negative effect of increased costs was offset by higher demand for imports due to the exchange rate's impact on the price of imports relative to domestic goods. This analysis generated an elasticity estimate for import container traffic through Vancouver of .75, much lower than estimates for U.S. ports in the Leachman studies. Based on FMC calculations, Leachman's estimates indicated elasticity for Inland Point Intermodal (IPI) traffic of 15.0 for LA/Long Beach and 20.0 for the Puget Sound ports.

Similar methods were used to analyze the market performance of the Ports of Los Angeles and Long Beach. Based on data from the Bureau of Census on containerized import cargo from Pacific Rim countries, the market share of the Ports of Los Angeles and Long Beach fell from 56.5% in 2003 to 50.2% in 2011, while the share of the Port of New York/New Jersey increased from 9.0% to 11.6%. The port of New York/New Jersey captured the largest share of increases in Asian import traffic among the East Coast ports over this period.

The analysis is based on available data on cost changes from the date of Leachman's most recent estimates (2007) to 2011. This analysis focuses on competitive destinations located in the region between Chicago and New York, which is a critical market for the ports of LA/Long Beach and the Port of New York/New Jersey. The estimates suggest an increase in costs for the LA/LONG BEACH route relative to NY/NJ over this period. Bunker surcharges to East Coast ports increased substantially in 2009

[1] Leachman & Associates LLC In Association with T. Prince & Associates LLC, Strategic Directions LLC, & George R. Fetty & Associates, Inc. Modal Elasticity Study Prepared for Southern California Association of Governments, Sept. 8, 2005. Leachman & Associates LLC Final Report Port and Modal Elasticity Study Phase II Prepared for Southern California Association of Governments, Sept. 14, 2010.

[2] Cambridge Systematics, Inc. in association with the Puget Sound Regional Council, Gill Hicks & Associates, Foster Pepper PLLC, BST Associates and Dr. Robert Leachman Freight Investment Study prepared for Washington State Joint Transportation Committee January 2009. Dr. Leachman's analysis is included as Appendix B in the report.

when TSA introduced differential charges between West Coast and East Coast ports; however ocean rates declined more for East Coast destinations, and Western rail rates increased substantially. The net impact is an increase in relative costs for the LA/Long Beach routing relative to the Port of NY/NJ of approximately $182 per FEU. Based on these cost estimates, the elasticity of container traffic through the Ports of Los Angeles and Long Beach is estimated at 1.04.

Additional analysis was carried out to assess the impact of macroeconomic variables on port traffic. The Leachman methodology modeled the impact of inventory costs on port traffic. Based on the Leachman formulas, the interest rate is a prime determinant of inventory costs. The Leachman results suggest that an advantage in inventory costs could offset the negative impact on West Coast port competitiveness of higher transportation costs relative to East Coast routes. However, trends in interest rates suggest that inventory costs have declined substantially since 2007. By 2009 monthly US prime interest rates declined by approximately 60% from the peak of 8.25% in mid-2007 and have remained stable at 3.25% since November 2009. Based on the Leachman estimates, this would be expected to result in a substantial shift in traffic to East Coast ports. However, the market shares of East Coast relative to West Coast ports increased only modestly relative to the West Coast. The East Coast share of containerized Pacific Rim imports increased by 4.0% from 2007 to 2011, while the West Coast share fell by 2.0%. This casts doubt on the strong relationship between inventory costs and port traffic estimated by the Leachman studies.

The impact of regional variations in macroeconomic performance on port traffic was also analyzed. The analysis indicated a relationship between the market share of LA/Long Beach and personal disposable income (PDI) per capita in the Mideast and Great Lakes states. The Great Lakes region includes the key markets in the Ohio Valley; the Mideast region contains Pennsylvania and New York, the natural hinterland of the Port of New York/New Jersey. Income trends have diverged substantially in these two regions, with personal income in Great Lakes states falling relative to the national average and the Mideast states increasing. Incorporating the impact of these variables reduces the estimated elasticity for LA/Long Beach container traffic from 1.04 to .88.

The expansion of the Panama Canal has the potential to substantially alter the competitive balance of transportation costs in inland markets. Forecasts of the impact of the Panama Canal expansion have focused on uncertainties over two major factors which will have a major impact on relative costs: the level of tolls to be charged on vessels transiting the canal, and the pricing strategies of the Western Class 1 railways. In addition to these issues the change in the balance of power between the Eastern and Western Class 1 railways could have significant impacts on the competitive position of West Coast ports.

Changes to the cost structure of container movements via East Coast ports could have significant implications for West Coast ports due to the dependence of the Western railways on interline movements to reach customers east of the Mississippi. Cost reductions achieved by the Eastern Class 1 railways may make them less vulnerable to diversion of intermodal traffic to trucking. This may prompt them to re-evaluate their pricing strategy with regard to interline movements of West Coast container traffic. Consequently the outcome following expansion of the Panama Canal would be dependent not just on the pricing decisions of the Western railways – which have an incentive to ensure that the largest share of traffic continues to flow through West Coast ports – but also on those of the Eastern railways which can be expected to favour whichever route maximizes their profits.

From the perspective of the Eastern railways, negotiation of an increased rate division for West Coast container traffic may be a win/win strategy, because it would increase revenue on West Coast interline movements and any traffic diverted to East Coast ports would result in additional Eastern rail traffic. The

impact of higher interline rates is explored in this paper. Based on the Leachman cost estimates, the incremental rail cost for West Coast interline movements via CSX and/or NS is significantly lower than trucking costs from Chicago for the destinations analyzed in this study. Under a scenario of increased interline costs, the additional costs of transloading and trucking from Chicago would result in a shift of the area in which the LA/Long Beach route has a cost advantage inland from Cleveland and Columbus to Chicago.

Dealing with competitive challenges related to inland networks may require West Coast port authorities to expand beyond the traditional role of port infrastructure development to embrace a more active role in enhancing their competitiveness as an origin-destination routing, rather than simply as a gateway to inland networks. This would require an ability to measure and monitor competitiveness on an ongoing basis; an understanding of the factors influencing competitiveness and which of them are within the port's control, those which can be influenced by the port's strategy, and those which are entirely beyond their control; and a deeper understanding of shipper characteristics and the factors influencing their routing choices. However, they are currently ill-equipped to undertake a broader strategy due to a lack of basic information about the markets they serve.

- Ports have no reliable source of information on the final destinations of their traffic, or on the traffic routed through competing gateways.

- Ports have only fragmentary information on costs and transit times for their own traffic, and for traffic routed through competing gateways.

- Ports have little information on the service characteristics motivating shippers' choice of gateways, beyond the basic parameters of transportation costs and transit times. The Leachman estimates suggest that for major market regions the cost differentials are relatively minor among competing routes. Under these conditions, other service advantages may be decisive in influencing shippers' routing decisions. An understanding of these may be crucial in guiding strategies and infrastructure investments to improve port competitiveness.

Success will require a broader understanding of the factors affecting shippers' routing decisions than can be obtained from previous research.

2 Conventional Wisdom on West Coast Port Competition

The primary source of conventional wisdom on West Coast port is a series of studies undertaken by Leachman and Associates for the Southern California Association of Governments (SCAG)[3] and for the Washington State Joint Transportation Committee[4]. A brief review of the methodology and results of these studies is given below.

In Phase 1 of the SCAG study a microeconomic model was developed to assess the long term impacts of container fees to finance infrastructure investments to accommodate growth in container traffic. The model allocated imports among ports and modes so as to minimize total transportation and inventory costs from the point of view of importers. Data on transportation costs was obtained directly from shippers and transportation service providers. Inventory costs in the model are based on the value of goods imported and transit times for alternative routings. Modal options included direct rail for international containers (IPI), direct truck and local dray, transload rail, and transload truck and local dray.

The elasticity estimates in the Phase 1 study were long term in nature because the model did not take into account existing capacity constraints nor the impact of traffic shifts on transit times as a result of congestion. The Phase 2 model was expanded to include these factors through the development of a methodology for estimating congestion impacts based on queuing theory. The model was calibrated to 2005 and 2006 trade data and shipper costs were based on levels prevailing in April 2007.

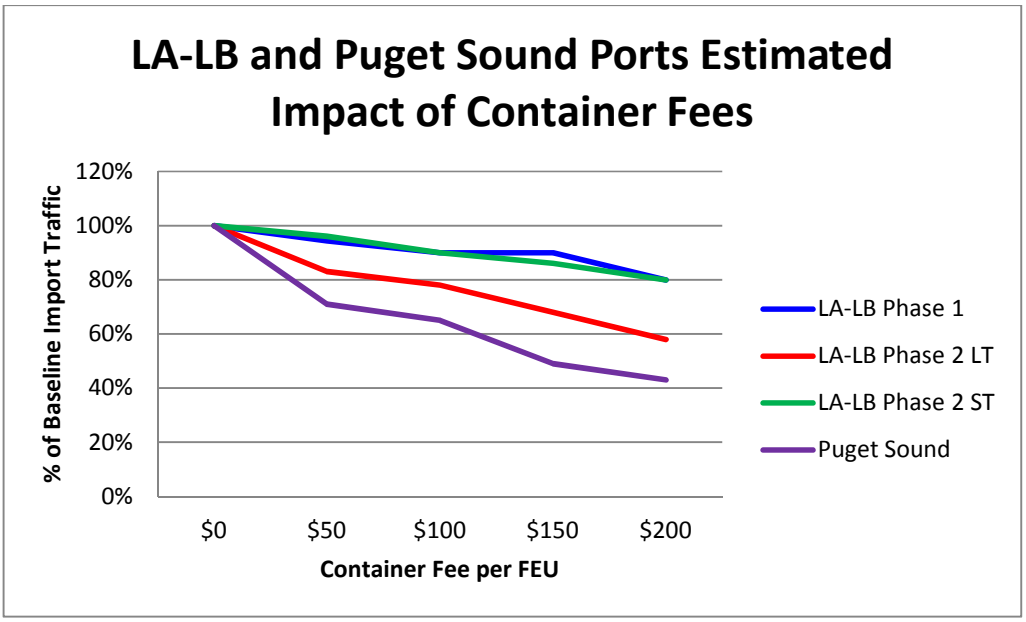
A separate study on the elasticity of traffic through the Puget Sound ports of Seattle and Tacoma based on the Phase 1 model was conducted by Leachman and Associates in 2008 as part of a larger Freight Investment Study undertaken for the Washington State Joint Transportation Committee. This study estimated that the Puget Sound ports' traffic was extremely sensitive to cost increases, with a reduction in volume of approximately 25% for a container fee of $30 per TEU.

Approximate estimates of the impact of container fees on import traffic for the Ports of Los Angeles and Long Beach from the two SCAG studies, and for the Puget Sound ports, are illustrated below. The Phase 2 study estimates suggest a much higher elasticity than the Phase 1 study.

[3] Leachman & Associates LLC In Association with T. Prince & Associates LLC, Strategic Directions LLC, & George R. Fetty & Associates, Inc. Modal Elasticity Study Prepared for Southern California Association of Governments, Sept. 8, 2005. Leachman & Associates LLC Final Report Port and Modal Elasticity Study Phase II Prepared for Southern California Association of Governments, Sept. 14, 2010.

[4] Cambridge Systematics, Inc. in association with the Puget Sound Regional Council, Gill Hicks & Associates, Foster Pepper PLLC, BST Associates and Dr. Robert Leachman Freight Investment Study prepared for Washington State Joint Transportation Committee January 2009. Dr. Leachman's analysis is included as Appendix B in the report.

Figure 2-1 Leachman Estimated Impact of Container Fees La/Long Beach and Puget Sound Ports



The extent to which these estimates have been accepted as conventional wisdom is illustrated by the recent Federal Maritime Commission inquiry on the Harbor Maintenance tax. The inquiry was undertaken in October 2011 in response to complaints from elected representatives, primarily from the Pacific Northwest. The contention that routing of Trans-Pacific container traffic through US ports is highly sensitive to relative cost differentials played a major role in both the genesis and in the conclusions of the inquiry.

The key role that the Leachman elasticity estimates played in the inquiry is highlighted by the submission of the Port of Seattle:

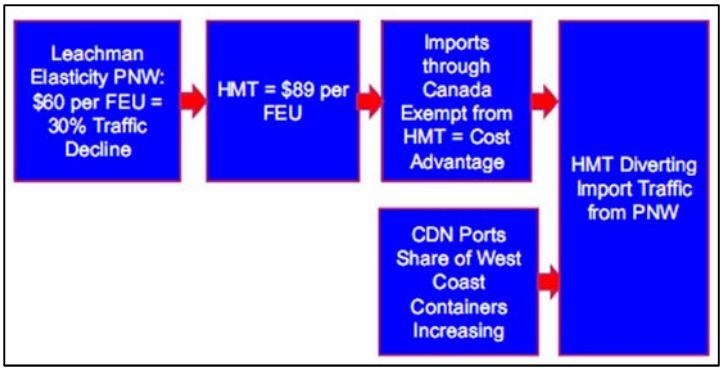
> *Cost is one of the most important elements in cargo routing decisions. The HMT is only one of several factors contributing to cost differences involved with shipping through various ports, but it is significant enough to influence shippers' decisions. In 2007 the Washington State Legislature commissioned a study that analyzed the impacts imposing a new container fee would have on Puget Sound cargo volumes. This peer-review elasticity study concluded that imposing a $60 per FEU fee on inbound containers would cut import volumes at Puget Sound ports by approximately 30%. A $150 fee could cut traffic in half. Anecdotal information from Port of Seattle customer relations staff supports this conclusion that small cost differences affect port choice.*[5]

Similar comments were submitted by the Washington Public Ports Association.[6]

The logic behind the FMC inquiry is represented by the diagram below:

[5] Port of Seattle Comments for Federal Maritime Commission Inquiry US inland Cargo Moving through Canadian and Mexican Seaports Docket No. 11-19 December 22, 2011 p. 7.
[6] Re: US Containerized Cargo Flows Notice of Inquiry Washington Public Ports Association December 21, 2011.

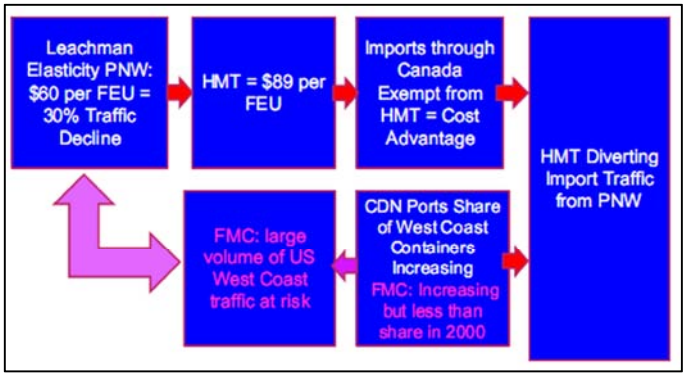
Figure 2-2 FMC Inquiry Logic Diagram



The results of the FMC inquiry did not support the conclusion that Canadian ports (and particularly the Port of Prince Rupert) have captured a significant share of US containerized import cargo to date. The inquiry indicated that in 2010 Canadian transhipments accounted for approximately 425,000 TEU's of a total of 17 million TEU's, or a market share of approximately 2.5%.[7] Of this, only 236,436 TEU's were imported through the West Coast ports of Vancouver and Prince Rupert and crossed the border by rail.[8] The market share of Canadian ports in US containerized imports is lower than in 2000, though the report noted that transhipments through Canada have increased since the Port of Prince Rupert commenced container operations in 2007.

However, the conclusions of the inquiry included the assertion that almost 1.9 million TEU's of current US West Coast Inland Point Intermodal (IPI) traffic is vulnerable to diversion based on the Leachman elasticity estimates.[9] This suggests that the FMC accepted the conclusions of the Leachman studies in spite of limited evidence of current diversion.

Figure 2-3 FMC Inquiry Logic Diagram - Conclusions



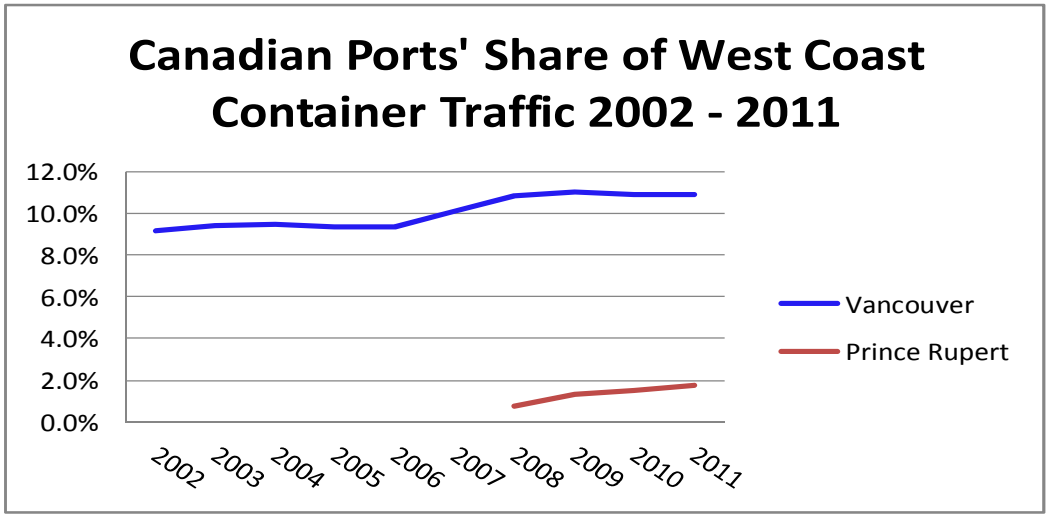
[7] Study of U.S. Inland Containerized Cargo Moving Through Canadian and Mexican Seaports July 2012 pp. 18-22.
[8] Ibid., p. 54.
[9] Ibid., pp. 54-55.

3 Port of Vancouver

The FMC tacitly accepted the position that US West Coast cargo traffic is highly sensitive to relative cost differentials. This raises two issues: Is the market share of Canadian ports in the TransPacific container trade increasing? And if so, is it due to a decline in costs relative to US ports?

On the first question it is clear that the Ports of Vancouver[10] and Prince Rupert have increased their share of TransPacific container trade. Based on port statistics, Vancouver's share increased from 9% in 2002 to 11% in 2011.

Figure 3-1 Canadian Ports' Share of West Coast Container Traffic



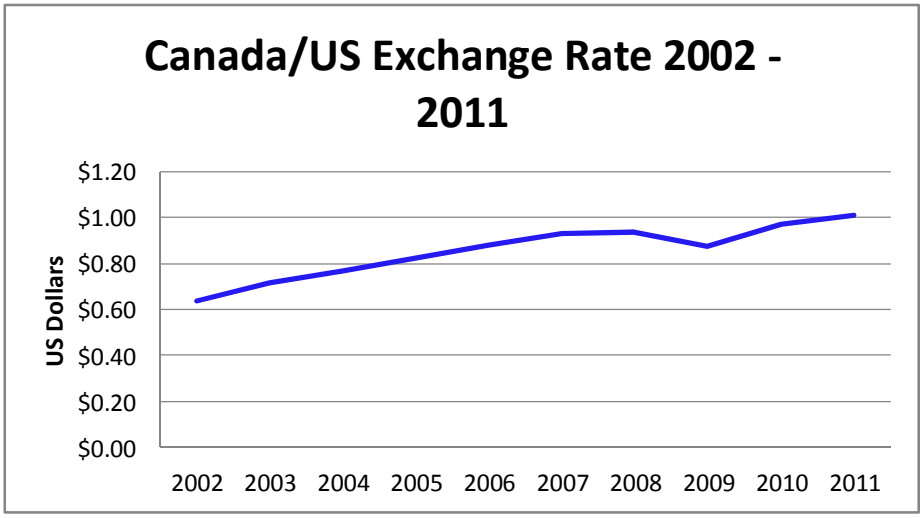
On the second question, it is not clear that this is the result of reduced costs relative to US ports. Based on the research summarized below, this can be attributed to the influence of macroeconomic variables and inland transportation networks rather than cost advantages.

3.1 Exchange Rates – Cost Impacts

The major macroeconomic change influencing the competitiveness of Canadian ports over this period was the exchange rate. The Canadian dollar increased by 36% against the U.S. dollar from 2002 to 2011, which led to higher rather than lower port and inland transportation costs relative to US ports for Pacific Rim import traffic.

[10] Prior to 2008, there were three port authorities in BC's Lower Mainland: the Vancouver Port Authority, the Fraser River Port Authority, and the North Fraser Port Authority. These organizations were amalgamated to create the Vancouver Fraser Port Authority (Port Metro Vancouver) in 2008. For convenience, the Lower Mainland ports will be referred to as the Port of Vancouver throughout this paper.

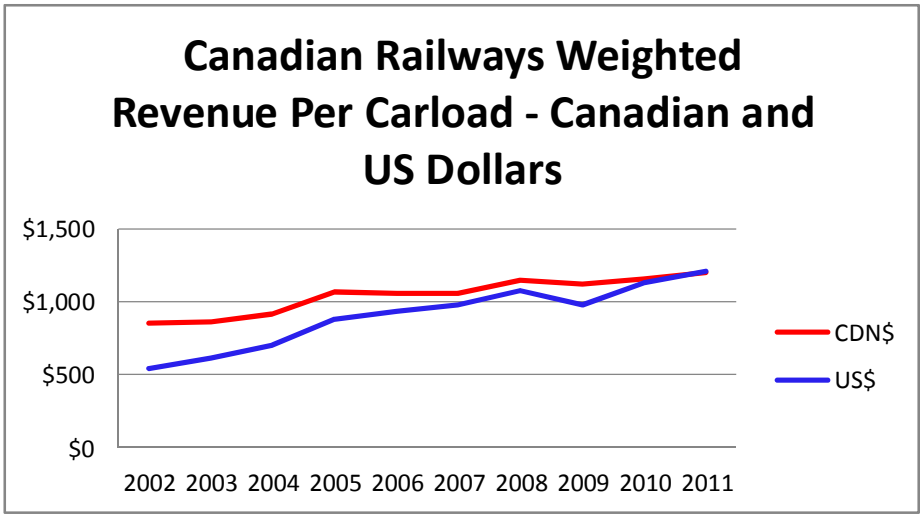
Figure 3-2 Canada/US Exchange Rate 2002 – 2011



The impact of the appreciation of the Canadian dollar is felt with regard to port and inland costs. Ocean shipping costs are unlikely to be affected since they are quoted in US dollars. For purposes of this analysis, the focus is on intermodal rail costs, in part due to the difficulty in obtaining representative data on comparative port costs.

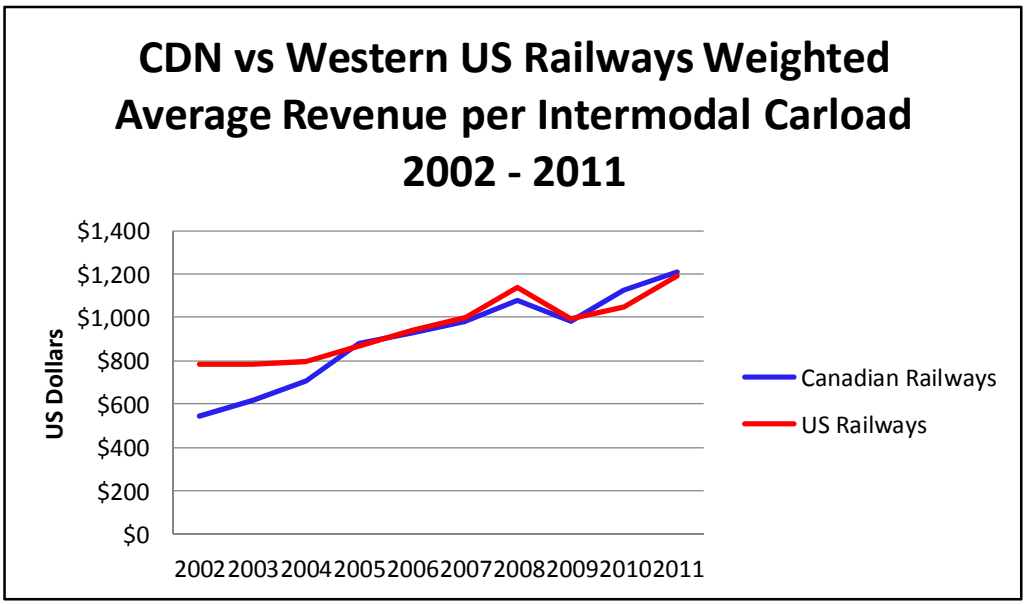
Average rates paid by shippers, based on reported average revenue per intermodal carload from CN and CP Rail, are shown below. The impact of the exchange rate on the competitiveness of Canadian routings is evident in the more rapid growth in US$ rates over this period.

Figure 3-3 Canadian Railways Revenue Per Carload 2002 – 2011



A comparison between intermodal revenue carload for the Canadian (CN and CP) and Western US (BNSF and UP) class 1 railways is shown below. At the beginning of the period Canadian rail rates were only 69% of comparable rates for the US railways. By 2005 they had reached par, and since 2010 have exceeded the US rates.

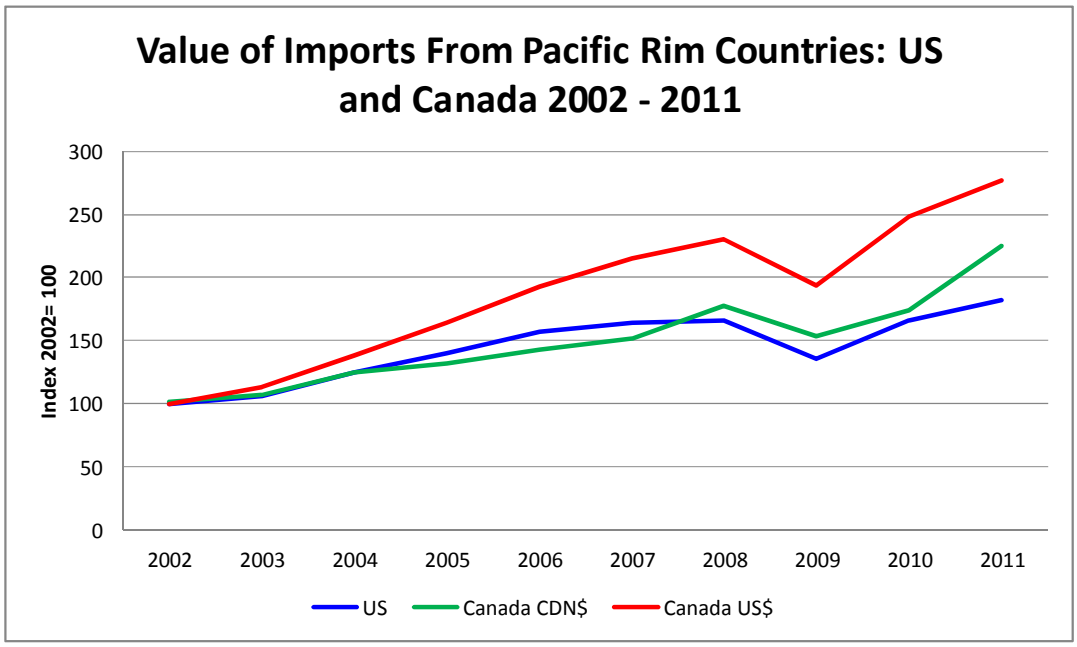
Figure 3-4 Canadian vs Western US Railways Average Revenue per Carload



3.2 Exchange Rates – Demand Impacts

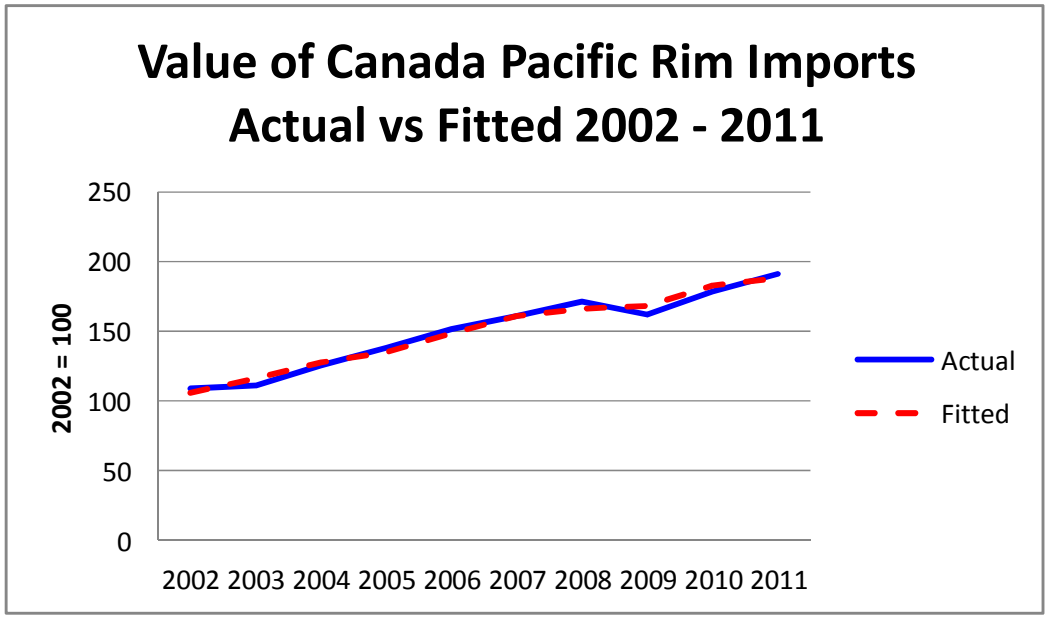
The exchange rate has impacts on demand as well as costs. In domestic currencies, Canadian and US imports from Pacific Rim countries grew at similar rates. However, measured in US dollars Canadian imports grew much more quickly. Under the assumption that most products imported from Asia are priced in US dollars, this implies a corresponding increase in the volume of trade.

Figure 3-5 US and Canada Value of Imports from Pacific Rim Countries



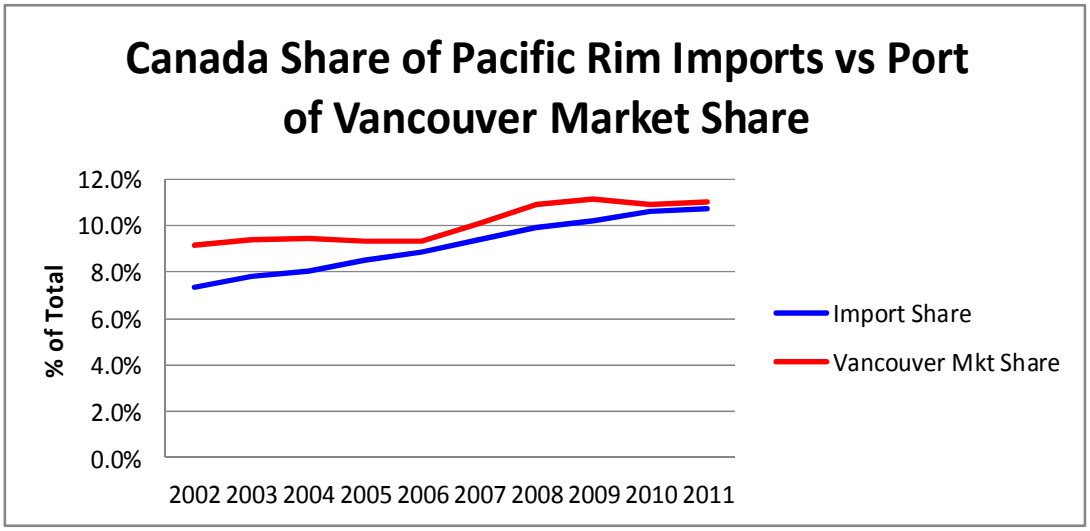
The growth in Canadian imports can be attributed to growth in personal income, and to the relative decline in import prices which resulted from the increased value of the Canadian dollar. A linear regression of the index of the value of import (in Canadian dollars) on indexes of personal disposable income and the ratio of import to domestic prices gives an adjusted R^2 of .87 with appropriate signs for the coefficients. The actual and fitted values are shown below.

Figure 3-6 Canadian Pacific Rim Imports Actual vs Fitted



The figure below illustrates the impact of rapidly rising Canadian imports on Port of Vancouver traffic. The market share of the Port of Vancouver (based on West Coast port container statistics) rose in tandem with the rising Canadian share of North American imports from Pacific Rim countries.

Figure 3-7 Canada Share of Pacific Rim Imports vs Port of Vancouver Market Share



3.3 Elasticity of Vancouver Port Traffic

The methodology for estimating the impact of elasticity of Port of Vancouver container traffic incorporates a regression of market share based on cost differentials. The analysis is based on time series data and includes consideration of the differential growth rate between Canadian and U.S. Pacific Rim imports from 2002 to 2011, reflected in the Canadian share (measured in U.S. dollars) of total imports.

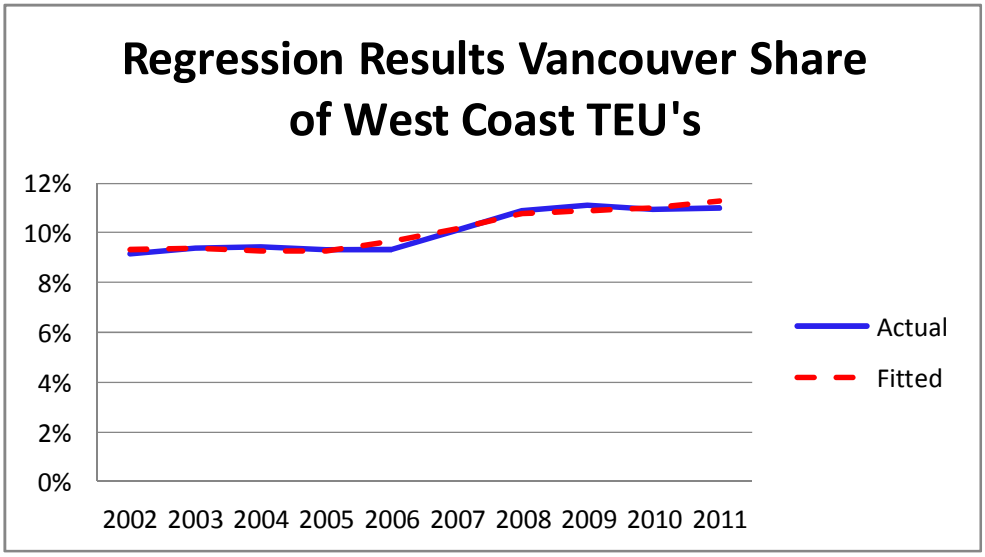
The cost variable included in the regression is the ratio of Canadian vs Western U.S. Class 1 intermodal revenue per carload, measured in U.S. dollars. Ideally the analysis would incorporate ocean and port costs as well, but data was not available for purposes of this study. For purposes of the regression analysis, we have assumed that differentials between port and ocean shipping costs between the Lower Mainland and U.S. West Coast ports were unchanged over the study period. Therefore the equation is used to estimate the partial elasticity of port traffic based on intermodal rail costs.

A linear regression of the Lower Mainland's share of West Coast container traffic from 2002 to 2011 on the Canadian share of U.S. and Canadian Pacific Rim imports (in U.S. dollars) and the ratio of Canadian relative to U.S. rail intermodal costs yields an adjusted R^2 of .93 with all variables significant at the 95% level. The estimated regression equation is shown below:

Lower Mainland TEU Share = .05 +.902 (Canadian Import Share) – .033 (Canadian/US Rail Cost Ratio)

Actual vs fitted data is shown below.

Figure 3-8 Regression Results: Vancouver Share of West Coast Container Traffic



Based on this regression, the partial elasticity of Lower Mainland container traffic to rail rate increases is .30. Assuming an ocean shipping rate of $1800 per FEU, this would result in a total elasticity estimate of .75.[11]

This is much lower than estimates for U.S. ports in the Leachman studies. Based on FMC calculations, Leachman's estimates indicated elasticity for Inland Point Intermodal (IPI) traffic of 15.0 for LA/Long Beach and 20.0 for the Puget Sound ports.[12]

[11] For convenience elasticity estimates are expressed as positive rather than negative quantities.

3.4 Inland Transportation Networks

The relatively low elasticity of Vancouver container traffic can be attributed to characteristics of the inland tranportation network connecting the port to its major markets in Eastern Canada.

- Intramodal competition in the Lower Mainland's core Canadian market is limited by the lack of direct access by U.S. Class 1 railways. In order to provide direct intermodal service to the major Eastern Canadian market, UP and BNSF would have to interchange traffic with the Canadian railways in Chicago. It is hard to imagine a scenario (short of a merger) which would induce CN or CP to offer an interline rate or level of service which would make the Western U.S. Class 1 railways competitive with the Canadian routing.

- Intermodal competition from trucking is limited by the distance from West Coast ports to Eastern Canadian markets.

These characteristics limit competition from US routings.

However, Canadian imports from Pacific Rim countries have grown faster than Port of Vancouver traffic. This suggests that the Port of Vancouver has been losing market share in the Canadian market. A portion of this traffic appears to have been diverted to the Port of Prince Rupert. Other alternative routings for this traffic can be deduced from Statistics Canada import trade data. Based on this data, the share of Pacific Rim imports entering Canada through the four Canada-US land border crossings increased from 14.6% in 2002 to 19.9% in 2011, which implies that US ports have increased their share of the Canadian market.

[12] Study of U.S. Inland Containerized Cargo Moving Through Canadian and Mexican Seaports p. 55.

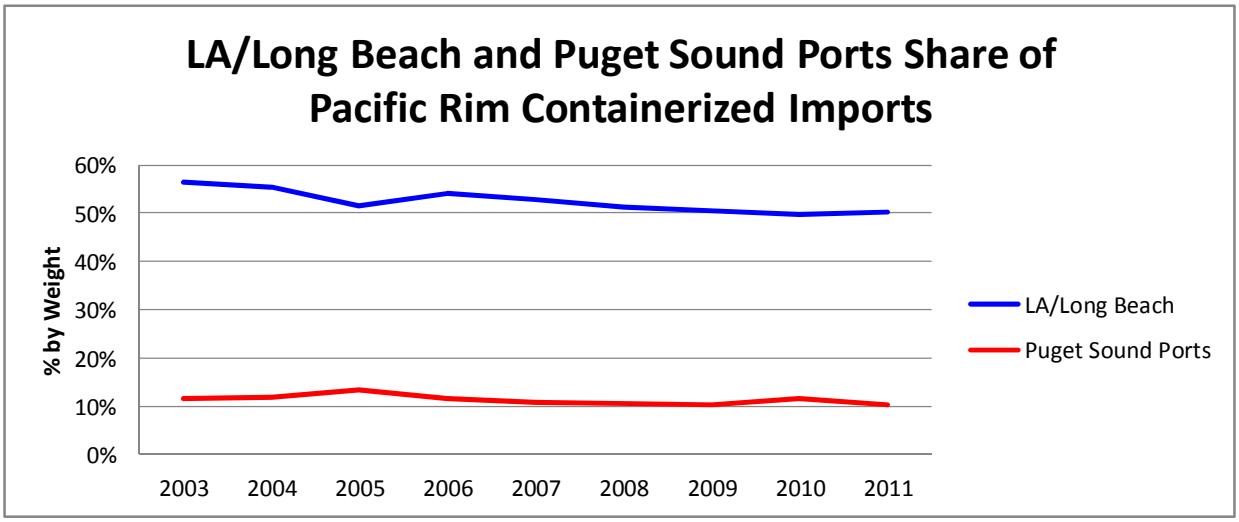
4 Los Angeles/Long Beach

The example of the Port of Vancouver illustrates the impact of macroeconomic variables and inland networks on port competitiveness. This chapter uses similar methods to analyze the competitiveness of the Ports of Los Angeles and Long Beach relative to their major competitors for Pacific Rim import traffic.

4.1 Los Angeles/Long Beach Market Shares

For purposes of analyzing US port competitiveness for TransPacific container traffic, data from the Bureau of Census on containerized import cargo from Pacific Rim countries appears to be the most appropriate measure of market share. Using this measure, the market share of the Ports of Los Angeles and Long Beach fell from 56.5% in 2003 to 50.2% in 2011. In comparison, the Puget Sound ports' share fell from 11.6% to 10.4% over the same period.[13]

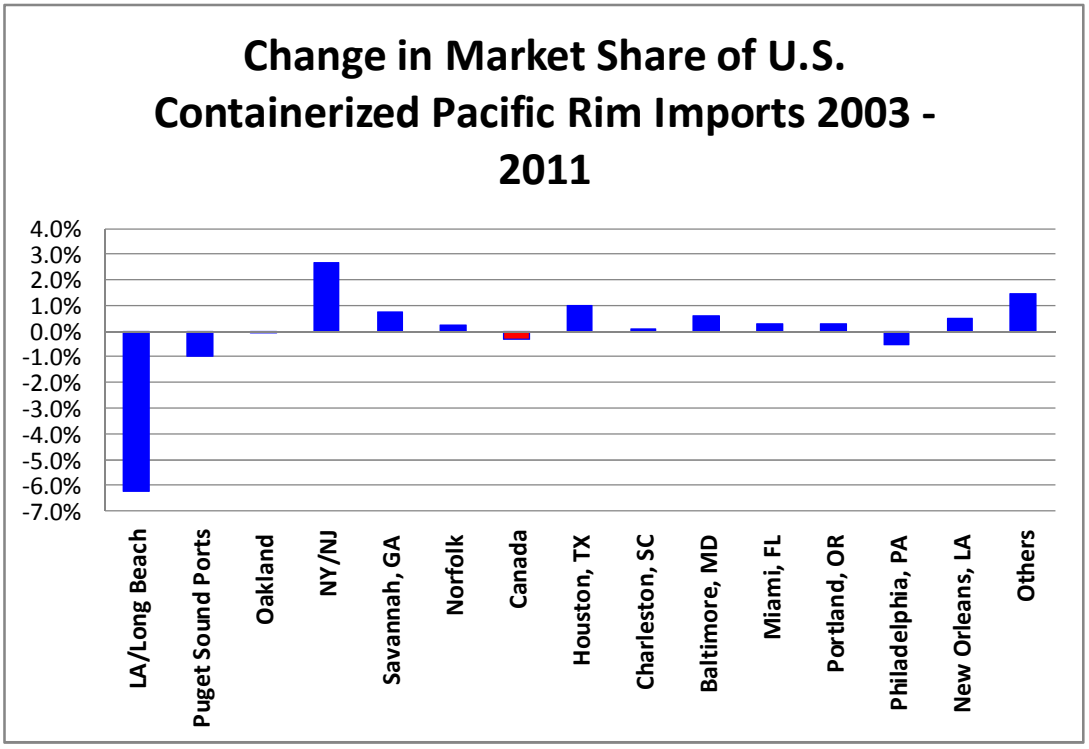
Figure 4-1 LA/Long Beach and Puget Sound Pacific Rim Market Shares 2003 – 2011



The changes in the share of US containerized imports from Pacific Rim countries among US and Canadian ports is shown below. The largest increase was recorded by the Port of New York/New Jersey, which saw its share increase from 9.0% in 2003 to 11.6% in 2011. Houston's market share increased from 1.3% to 2.3%. Savannah's share increased from 5.7% to 6.5%. Increases for these three ports amounted to approximately 70% of the share lost by the Ports of LA and Long Beach over this period. The remainder was widely distributed among the remaining ports.

[13] Source: US Bureau of Census USA Trade Online.

Figure 4-2 Changes in US Ports' Share of Pacific Rim Containerized Imports 2003 – 2011



The Leachman studies analyzed port market shares as a function of transportation and inventory costs. These costs are analyzed below, based on available data in cost changes from the date of Leachman's most recent estimates (2007) to 2011.

4.2 Transportation Costs

This analysis of transportation costs focuses on competitive destinations between Chicago and New York, which is a critical market for the ports of LA/Long Beach and the Port of New York/New Jersey, which has seen the most dramatic growth in Asian import traffic. This area includes states in the Great Lakes and Mid-East regions defined by the Bureau of Economic Advisors.[14] The market area and major intermodal destinations are shown below.

[14] Source: State Personal Income: Second Quarter 2012 Bureau of Economic Advisors. The Great Lakes states include Illinois, Michigan, Indiana, Wisconsin and Ohio. The Mid-East Region includes New York, New Jersey, Pennsylvania, Delaware, Maryland and the District of Columbia. http://www.bea.gov/newsreleases/regional/spi/spi_newsrelease.htm

Figure 4-3 Market Area Focus

The market area consists of regions analyzed by Leachman to estimate total transportation costs for specific destinations including Chicago, Columbus, Cleveland, Pittsburgh, Harrisburg and New York. For all of these destinations, the routing with lowest transportation costs was either the Ports of LA/LONG BEACH or the Port of NY/NJ. Within this region, the Ohio Valley has been characterized as "the new battleground between West and East Coast ports."[15]

Leachman's transportation cost estimates for IPI containers from Shenzen/Yantian/Chiwan to these destinations in 2007 are shown below.[16] They have been converted from dollars per cubic foot to dollars per FEU for ease of comparison. The estimates suggest that costs through LA/Long Beach were lower as far east as Pittsburgh.

Figure 4-4 Leachman Cost Estimates 2007

Leachman Cost Estimates 2007 (FEU equivalent)			
Destination	**LA/Long Beach**	**NY/NJ**	**LA/LB Advantage**
Chicago	$3,593	$4,335	$742
Cleveland	$3,880	$4,095	$216
Columbus	$3,880	$4,119	$240
Pittsburgh	$3,976	$4,072	$96
Harrisburg	$4,143	$3,832	-$311
NY-NJ	$4,311	$3,832	-$479

[15] Source: Theodore Prince, quoted in "More Increases Expected for Rail Rates" Shipping Digest Bill Mongeluzzo, October 22, 2007. This area is also identified as a major area of competition following expansion of the Panama Canal in Panama Canal Expansion Impacts NJTPA/NYMTC Scudder Smith, Parsons Brinckerhoff April 16, 2012.
http://www.njtpa.org/Involved/Forum/panama_FIC/powerpoints/ScudderSmith.pdf
[16] Source: Final Report Port and Modal Elasticity Study Phase II pp. 57-61.

These costs are used as the base for calculating changes in transportation costs for purposes of estimating cost elasticity for the period 2007 to 2011. The estimates are developed in a two stage process:

- Costs for individual components of the 2007 values (rail rates, ocean shipping rates, and bunker and inland fuel surcharges) are estimated based on available public data.

- Costs for 2011 are estimated based on indexes of cost changes and published surcharges over this period.

Data on cost changes is taken from the following sources:

- The TransPacific Stabilization Agreement, the discussion group for ocean carriers on the Eastbound Transpacific routes, publishes an index showing the average revenue (net of bunker surcharges) received by carriers on West Coast and East Coast routes. The data is indexed to rates prevailing in the second quarter of 2008 and includes monthly data from January 2010.

- Data on bunker surcharges is taken from the TSA Bunker Fuel Charges Fact Sheet.[17]

- Data on inland fuel surcharges is taken from the TSA Inland Fuel Cost Recovery Fact Sheet.[18]

- Data on rail rate increases is based on quarterly Average Revenue per Carload for intermodal traffic reported in Union Pacific Railroad financial reports.

- Data on trucking cost changes is based on the Bureau of Labour Statistics index of long haul truckload rates.[19]

Comparative shipper cost changes (based on producer revenues) from 2008 to 2011 are illustrated below. The comparison shows a substantial increase in rail rates over this period. Rail rates increased by almost 20%; shipping line rates have declined by a similar percentage; and trucking rates have basically recovered to the level at the beginning of the period.

The formula for calculating bunker surcharges changed substantially over this period. Prior to May 2009, West Coast and East Coast shipments were subject to the same bunker surcharge. On that date, ocean carriers began a transition to surcharges reflecting operational and fuel cost differences between West Coast and East Coast routes. The result was a substantial increase in bunker surcharges for East Coast routes relative to the West Coast.[20]

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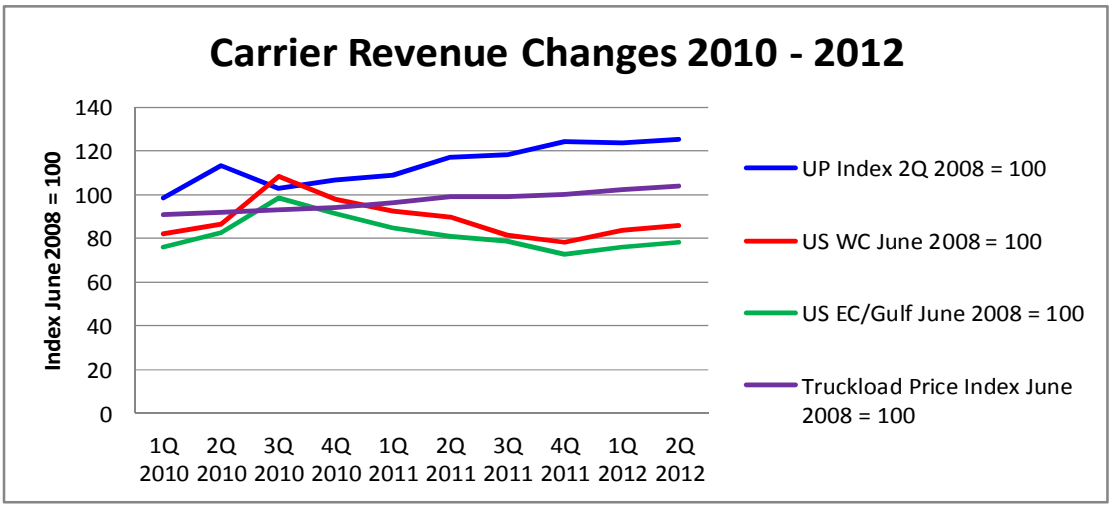
[17] "TSA Bunker Fuel Charges Fact Sheet" http://www.tsacarriers.org/fs_bunker.html
[18] "TSA Inland Fuel Cost Recovery Fact Sheet" http://www.tsacarriers.org/fs_inland.html
[19] Bureau of Labour Statistics Producer Price Index Series Id: PCU4841214841212 http://data.bls.gov/cgi-bin/surveymost?pc
[20] "TSA Bunker Fuel Charges: A Refined Approach Fact Sheet" previously posted on the TSA website. Bunker surcharges were subsequently revised in 2012 to account for the impact of slow steaming and low sulfur fuel requirements.

Figure 4-5 Carrier Revenue Changes 2010 – 2012



The impact of changes in rates and bunker and inland fuel charges on port competitiveness is analyzed below, based on estimated changes to costs to Chicago and New York via the Ports of LA/Long Beach and New York/New Jersey. Because TSA has not divulged the actual level of shipping line rates, the rates prevailing in 2008 have been estimated based on Leachman's 2007 total cost estimates and available data on rail rates and fuel surcharges. The rail rates are reasonably consistent with data published by TSA in 2009, and fuel surcharges are based on calculations from the TSA website.[21]

Figure 4-6 Chicago and New York Transportation Cost Estimates 2007 and 2011

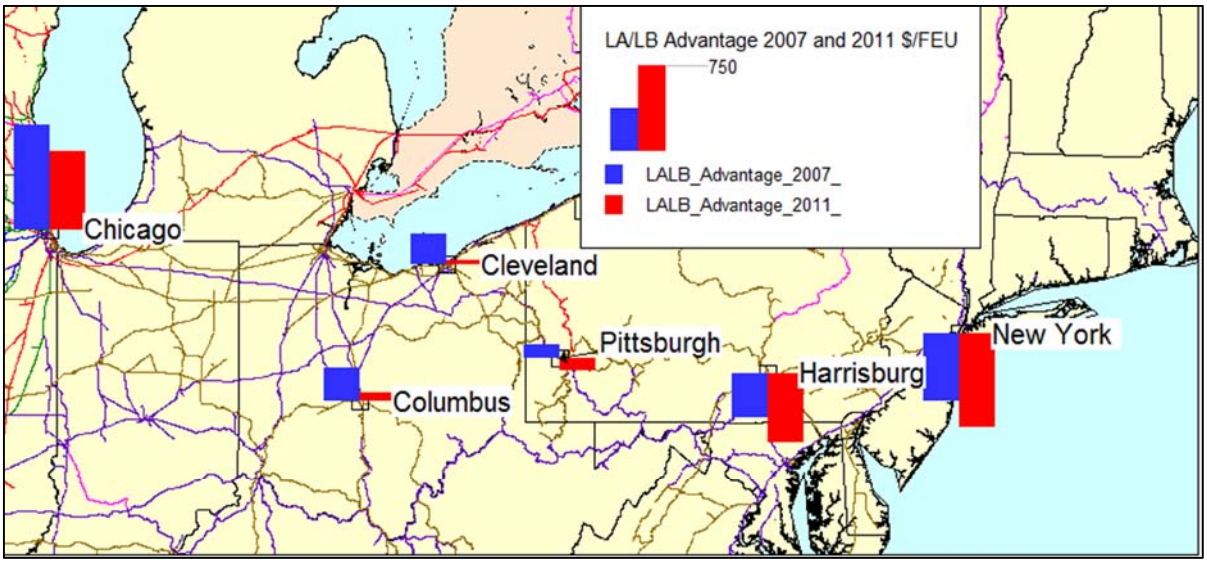
Chicago and New York Container Costs 2007 and 2011						
2007 Estimates						
Destination	**Port**	**Total Costs Direct Rail**	**Direct Inland Costs Net of Surcharges**	**Bunker Surcharge**	**Inland Surcharge**	**Estimated Ocean Costs**
Chicago	LA/Long Beach	$3,593	$998	$635	$299	$1,660
Chicago	NY-NJ	$4,335	$679	$635	$204	$2,817
NY-NJ	NY-NJ	$3,832	$300	$635	$0	$2,897
2011 Estimates						
Destination	**Port**	**Total Costs Direct Rail**	**Direct Inland Costs Net of Surcharges**	**Bunker Surcharge**	**Inland Surcharge**	**Estimated Ocean Costs**
Chicago	LA/Long Beach	$3,401	$1,189	$568	$353	$1,291
Chicago	NY-NJ	$3,961	$663	$1,107	$177	$2,014
NY-NJ	NY-NJ	$3,478	$300	$1,107	$0	$2,071
Drayage costs New York estimated at $300; inland rail costs NY-NJ to Chicago based on NS avg rev per carload 2008 & 2010						
Change 2007 - 2011						
Chicago	LA/Long Beach	-$191	$191	-$67	$54	-$369
Chicago	NY-NJ	-$374	-$16	$472	-$27	-$803
NY-NJ	NY-NJ	-$354	$0	$472	$0	-$826

[21] In calculating inland fuel surcharges for 2009, TSA published average costs of $1,055 per FEU longhaul rail; $527 per FEU Reverse Inland Point Intermodal (IPI via East Coast ports); and $305 per FEU short haul truck.

The estimates suggest an increase in costs for the LA/Long Beach route relative to NY/NJ over this period. Bunker surcharges to East Coast ports increased substantially in 2009 when TSA introduced differential charges between West Coast and East Coast ports; however ocean rates declined more for East Coast destinations, and Western rail rates increased substantially. The net impact is an increase in relative costs for the LA/long Beach routing relative to the Port of NY/NJ of approximately $182 per FEU.

The impact of these changes on the competitive position of LA/Long Beach is shown below.

Figure 4-7 Transportation Cost Advantage LA/Long Beach 2007 vs 2011



Based on these estimates, the transportation cost advantage for container movements to Pittsburgh shifted to the Port of NY/NJ, and the cost advantage for the LA/Long Beach route to Columbus and Cleveland was substantially reduced.

Using the 2007 LA/Long Beach market share as the baseline for demand and an average value of $4000 for transportation costs in 2007,[22] the elasticity of LA/Long Beach container traffic based on the 2011 estimates is approximately 1.04.[23]

4.3 Inventory Cost – Interest Rates

Interest rates play an important role in the Leachman studies due to their impact on inventory costs. The results of the studies suggest that the savings in inventory costs achieved as a result of faster transit times through West Coast routings are a major factor in overcoming potentially lower transportation costs via East Coast ports.

[22] This is consistent with the average value used by the FMC in calculating elasticities from the Leachman studies.

[23] Elasticity is calculated as the % change in demand divided by the % change in price. The average change in costs amounts to an increase of 4.6%; the change in LA/Long Beach share of containerized Pacific Rim imports was -4.8% (52.7% to 50.2%).

Specifically, inventory costs are divided into pipeline and safety stock categories modelled as a function of the value of commodities transported, transit times and reliability. Total inventory cost is represented by:

$$(i)(V_P)(L)(D) + (i)(V_{RDC})(ss)$$

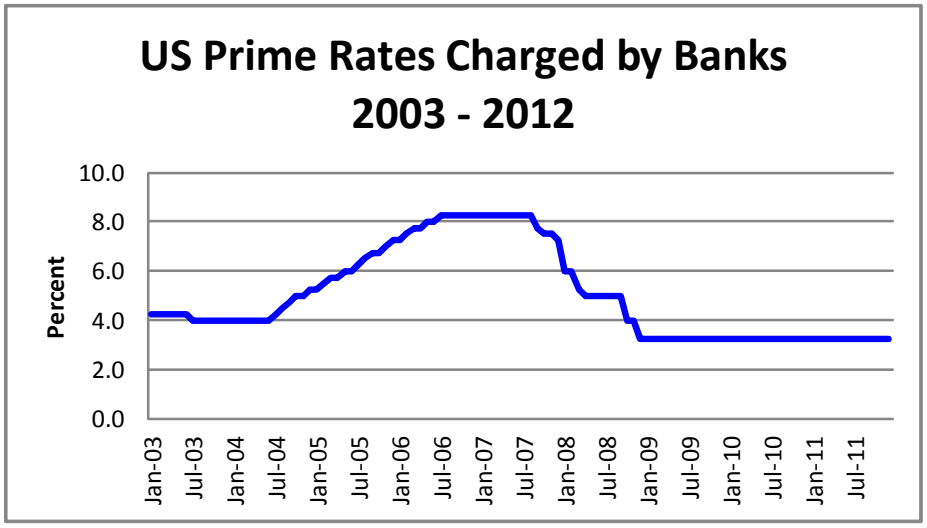
where:

- V_P = Capital per unit tied up in pipeline stock
- (L)(D) = Average pipeline inventory level
- V_{RDC} = Capital per unit tied up in safety stock
- ss = Level of safety stock
- i = Interest rate

Note that the interest rate enters into both pipeline and safety stock cost calculations, essentially as the price of holding inventory.

The Leachman results suggest that an advantage in inventory costs could offset the negative impact on West Coast port competitiveness of higher transportation costs relative to East Coast routes. However, trends in interest rates suggest that inventory costs have declined substantially since 2007. Monthly US prime interest rates from 2003 to 2012 are depicted below. Note that by 2009 interest rates had declined by approximately 60% from the peak of 8.25% in mid-2007 and have remained stable at 3.25% since November 2009.[24]

Figure 4-8 US Prime Interest Rates 2003 – 2012



The interest rates used to estimate inventory costs in the Leachman models substantially exceeded the prime rate. The Phase 1 model assumed an average cost of working capital of 35% for most goods, with

[24] Source: Bank of Canada U.S. Interest Rates Monthly series V122148 = U.S. - Prime Rate Charged By Banks.

a rate of 50% for electronics and fashion items to account for potential losses in value due to late arrival.[25] Regardless of the rate differentials, it is logical to assume that inventory costs would decline proportionately to the overall decline in benchmark interest rates.

The relationship between interest rates and LA/Long Beach share of Pacific Rim imports is positive, consistent with theoretical expectations, but the linkage is relatively weak with a correlation coefficient of only .178. Note that for the specific markets analyzed in this paper, based on the Leachman findings West Coast routings would dominate for destinations as far east as Pittsburgh since transportation costs are lower and inventory costs would also be lower due to the transit time advantage.

Since the downturn in 2008, shipping lines have implemented slow steaming on many routes. This has increased the transit time advantage for West Coast ports from approximately 6 days to 11.[26] Under slow steaming, transit times to the West Coast increased by 13% while to the East Coast they increased by 24%. This may have partially offset the impact of lower interest rates. TSA reduced bunker surcharges on slow steaming routes in 2012; however the changes are not reflected in this analysis.

4.4 Demand Impacts – Regional Income

For port competition, regional differences in economic activity are significant, due to the existence of natural port "hinterlands" based on proximity and cost advantages. For example, Leachman estimated that 23% of imports through the Ports of Los Angeles and Long Beach is destined for local markets in 2008, and that this traffic is essentially immune to competition from other ports[27].

To explore the impact of changes in regional income levels on port market shares, Bureau of Economic Advisors data on state and regional disposable income was assembled. [28] Indexes reflecting regional Personal Disposable Income Per Capita were divided by the US average to generate a comparative measure. Correlation coefficients between these ratios and the share of Pacific Rim imports through the Ports of Los Angeles and Long Beach are shown below.

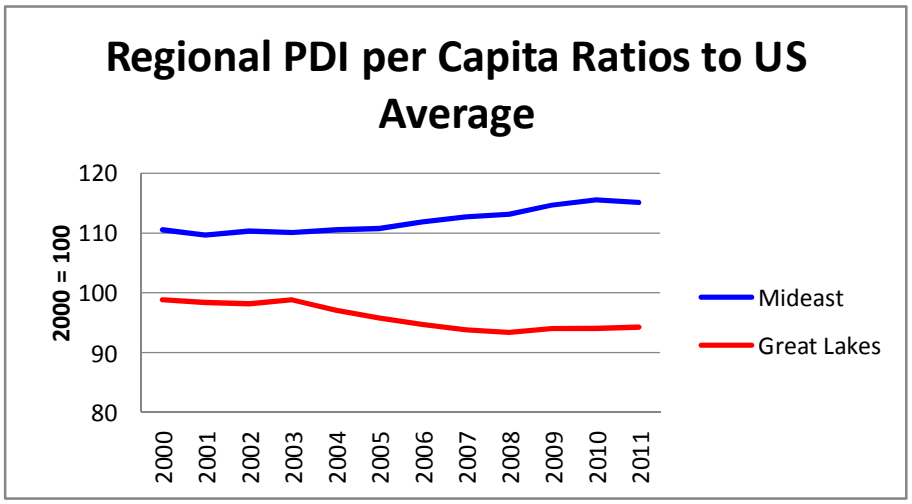
Figure 4-9 Relationship Between LA/Long Beach Market Share and Regional Income

LA/Long Beach Share of Pacific Rim Imports vs Regional Personal Disposable Income Per Capita 2003 - 2011	
Region	**Correlation Coefficient**
New England	-0.67
Mideast	-0.86
Great Lakes	0.82
Plains	-0.33
Southeast	0.02
Southwest	-0.88
Rocky Mountain	0.56
Far West	0.72

[25] Leachman 2005, p. 52.
[26] 2012 Global Logistics Trends Curtis D. Spencer, IMS Worldwide Inc. http://www.imsw.com/downloads/powerpoint/2012_Global_Logistics_Trends.pdf
[27] Leachman 2010, p.9.
[28] Personal Disposable Income data is taken from Bureau of Economic Advisors SA 51-53 Disposable Personal Income Summary.

The most interesting results in the context of this analysis are those illustrating the relationship between the market share of LA/Long Beach and PDI per capita in the Mideast and Great Lakes states. The Great Lakes region includes the key markets in the Ohio Valley; the Mideast region contains Pennsylvania and New York, the natural hinterland of the Port of New York/New Jersey. Income trends have diverged substantially in these two regions, as shown below.

Figure 4-10 Regional PDI Per Capita Ratios Mideast and Great Lakes



The poor performance of the Great Lakes region over the last decade has been attributed to the declining fortunes of the auto industry and the dependence of the regional economy on manufacturing, which is prone to cyclical downturns:

> *This region has been at the bottom of the list for more than three years, before the recession began, due to the accelerating loss of market share by its once dominant motor vehicle industry. Then the recession cut jobs and income in this region more than in the rest of the country because of the usual cyclical plunge of its large manufacturing sector.*[29]

Based on the correlation coefficients, LA/Long Beach market share is more closely related to the economic performance of the Great Lakes region than to local economic conditions as reflected in the Far West PDI per capita statistics. One possible explanation is a two-fold impact on import demand from declining Great Lakes region economic activity: a reduction in imports of intermediate goods for use in manufacturing (for example auto parts); and a reduction in consumer goods imports due to reduced personal income.

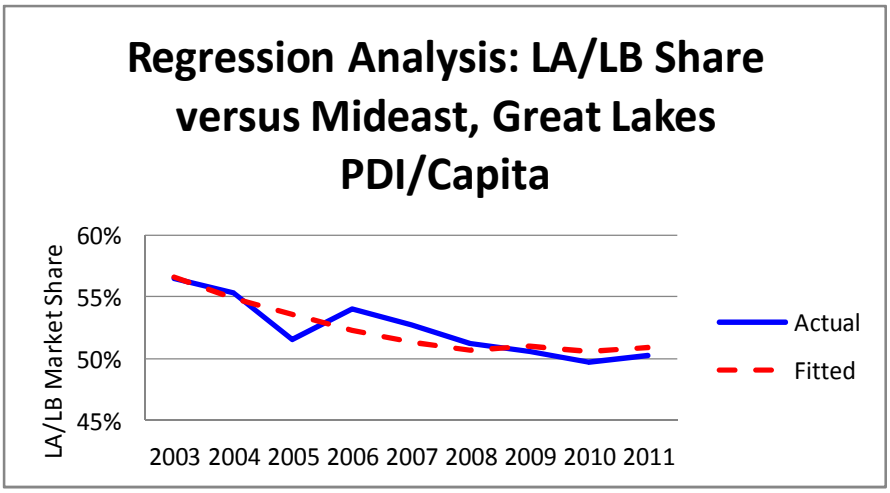
A regression of LA/Long Beach's market share on the regional PDI per capita ratios for the Great Lakes and Mideast regions confirms a strong relationship. The regression provides a reasonably good fit (adjusted R^2 = .86) and statistically significant coefficients. The estimated equation is:

LA/Long Beach Share = - 0.00298 Mideast PDI per capita + 0.00904 Great Lakes PDI per capita

[29] "New England states have slowest decline in economic growth" Jim Haughey, Reed Construction Data Chief Economist October 16, 2009 http://www.reedconstructiondata.com/construction-forecast/news/2009/10/new-england-states-have-slowest-decline-in-economic-growth/

where PDI per capita is measured as the ratio of regional PDI per capita to the national average. Actual vs fitted values are shown below.

Figure 4-11 LA/Long Beach Market Share and Regional Income Regression Results



Based on these estimates, changes in relative regional income accounted for a decline in market share for LA/Long Beach of .37% of total import traffic between 2007 and 2011. Incorporating this adjustment into the calculation of cost elasticity from section 4.2 generates a revised estimate of .88, compared to the original estimate of 1.04.

4.5 Conclusions

- The elasticity of demand for Pacific Rim containerized cargo is substantially lower than conventional wisdom suggests. Application of the Leachman estimates suggests an elasticity of 15.0 for import traffic through the Ports of Los Angeles and Long Beach. The estimates generated through analysis of relative cost changes through the Ports of LA/Long Beach and New York/New Jersey suggest an elasticity of 1.04; taking into account the impact of regional income changes, this falls to .88.

- The relationship between inventory cost and port choice appears to be weaker than suggested in the Leachman studies. Since the interest rate is a key variable in determining inventory costs, the low interest rates which have prevailed since 2009 have resulted in a substantial reduction in the cost of holding inventory. Under the Leachman model, this could reasonably be expected to generate a substantial shift of cargo (primarily higher-value commodities) to East Coast ports. This is not evident in the data.

- The impact of rail rate increases on transportation costs for containers routed via the Ports of Los Angeles and Long Beach highlights the critical importance of inland transportation networks to port competitiveness.

- The estimated impact of income growth differentials among regions highlights the influence of macroeconomic conditions on port market shares.

5 Strategic Challenges Following Expansion of the Panama Canal

The expansion of the Panama Canal is the most significant change affecting North American container logistics since the development of double stack landbridge service in the 1970's. Previously limited to 4,800 TEU vessels, the expanded canal will accommodate vessels up to 12,600 TEU's when it opens in 2014.[30] This has the potential to substantially alter the competitive balance of transportation costs in inland markets.

The Leachman cost estimates indicate that in 2007 the LA/Long Beach routing for IPI traffic enjoyed a transportation cost advantage as far east as Pittsburgh. The analysis in the previous section suggests that this transportation cost has been eroded due to the increase in rail rates relative to ocean and trucking costs. The canal expansion may further change the balance between ocean shipping and inland transportation costs. The use of larger vessels on East Coast routes has the potential to reduce ocean shipping costs relative to the West Coast, and recent investments by CSX and NS in their intermodal networks have reduced rail costs for inland movements.

Forecasts of the impact of the Panama Canal expansion have focused on uncertainties over two major factors which will have a major impact on relative costs: the level of tolls to be charged on vessels transiting the canal, and the pricing strategies of the Western Class 1 railways.[31] In addition to these issues, this chapter focuses on an issue which has not been previously highlighted: the change in the balance of power between the Eastern and Western Class 1 railways.

5.1 A Framework for Analysis

The preoccupation of forecasters with pricing decisions of the Panama Canal Authority and the Class 1 railways implicitly acknowledges that these agents have market power – the ability to affect prices or quantities in specific markets. The branch of economics which deals with market power is Industrial Organization.

The traditional Industrial Organization framework analyzes the impact of industry structure on the conduct and performance of firms. Major structural characteristics include industry costs, the number of firms in the market, and barriers to entry.

Industry costs: the balance between fixed and variable costs in an industry has a major influence on short run pricing behaviour. Fixed costs include capital investments in infrastructure and capital equipment such as container ships. High fixed costs in an industry can represent a barrier to entry since a large amount of capital is required to purchase the necessary capital assets. Variable costs include costs which vary with output such as wages and fuel costs.

Firms with high fixed costs relative to variable costs are more likely to reduce prices sharply in response to industry downturns, and may maintain prices at levels which do not fully cover the cost of capital for extended periods. This is particularly where fixed costs are incurred for purchase of assets which cannot be used for other purposes ("sunk costs") such as railway infrastructure. In contrast, firms with high variable costs relative to fixed costs cannot reduce their prices significantly since it would result in prices falling below the variable cost of production.

[30] U.S. Port and Inland Waterways Modernization Preparing for Post-Panamax Vessels Institute for Water Resources, U.S. Army Corps of Engineers June 20, 2012 p.17.

[31] See for example "Panama project threatens West Coast ports' lock on Asia trade" DC Velocity mark Solomon October 4, 2009 http://www.dcvelocity.com/articles/20091004panama_canal_west_coast_ports/

Number of firms in the market: the number of firms in a market is a common measure of firms' market power. Market power decreases as the number of firms increases because purchasers have more options.

Barriers to entry: barriers to entry are an important determinant of market power since firms' ability to raise prices may be limited by the possibility that high prices will provide an incentive for new firms to enter the market. These can include high capital costs, increasing returns to scale, and access to unique technology or scarce resources.

A comparison of structural characteristics of the key modes of transportation in North American container logistics is shown below.

Figure 5-1 Industry Structural Characteristics by Mode of Transport

Industry Structure by Mode			
	Steamship Lines	**Railways**	**Trucking**
Fixed Costs	High	High	Low
Variable Costs	Low	Low	High
Number of Firms	15 (TSA Members)	2 - 6 (depends on route)	Thousands
Barriers to Entry	Low	High	Low
Pricing Power	Low	High	Low

Steam ship lines have high fixed costs due to the capital costs of container vessels. However their pricing power is constrained by the number of firms offering competitive services. For example, there are 15 carriers who are currently members of the TransPacific Stabilization Agreement. While capital costs are high, barriers to entry on specific routes are low because vessels can be redeployed with minimal costs.

Railways have high fixed costs but less intramodal competition, depending on the specific origin and destination of shipments. For example, shipments to Chicago may be routed by one of 6 Class 1 railways and multiple ports. However destinations in the Western or Eastern regions of the US may be limited to one or two rail carriers. Unlike the other modes, the railway industry has almost insurmountable barriers to entry since it would be almost impossible to construct a new railway to compete with existing Class 1 railways.

The trucking industry has low fixed costs but high variable costs, a large number of competitive firms and low barriers to entry.

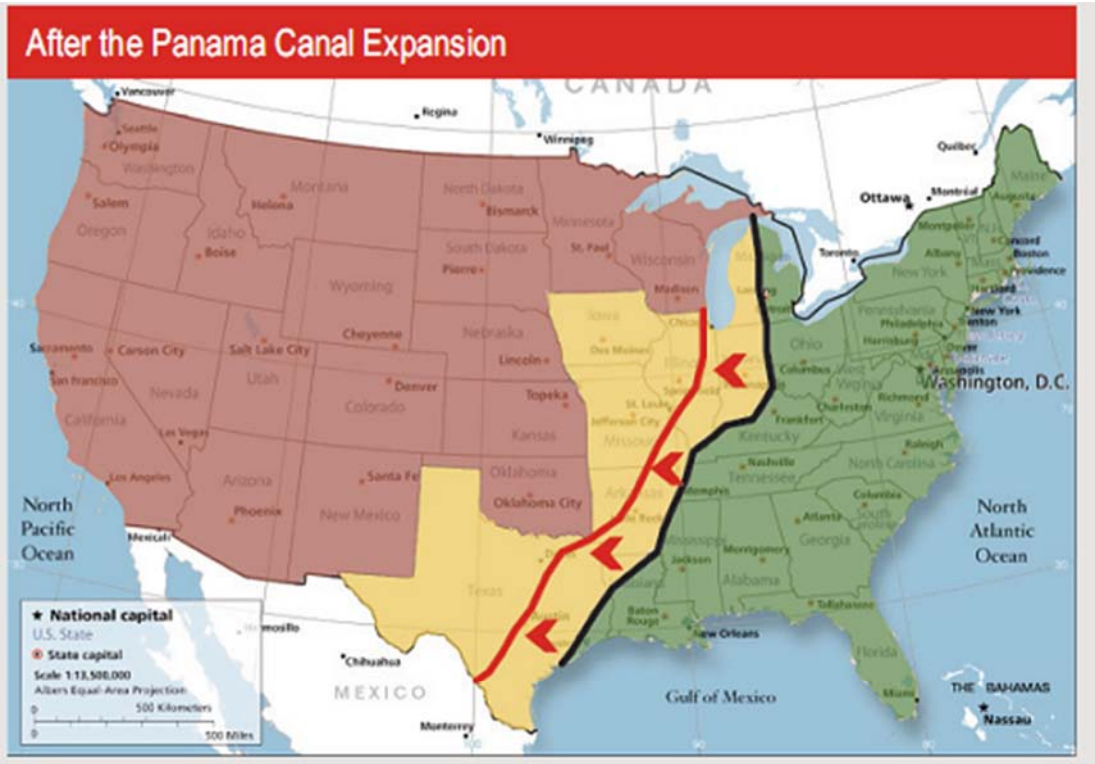
The changes in carrier revenues since the downturn in 2008 highlight the influence of these structural characteristics in each mode. As noted in section 4.2. Shipping line rates declined by approximately 20% while trucking rates declined by approximately 10%, and have since recovered to previous levels. Only the railways have succeeded in increasing their rates in the face of declining demand.

5.2 Shipping Cost Impacts of the Panama Canal Expansion

Expansion of the Panama Canal is anticipated to reduce ocean shipping costs on all water routes from Asia to the U.S. East Coast due to the economies of scale available from the use of larger vessels. Recent estimates by Parsons Brinckerhoff suggest that the reduction in costs may be as much as $400 per TEU ($800 per FEU). However, they estimate that carriers, ports and the Canal Authority may retain half of the cost savings; and that the reduction relative to West Coast ports may be as little as $100 per TEU ($200 per FEU).[32] This is approximately equal to the relative cost increase for West Coast routings from 2007 to 2011 which was estimated above.

Estimates of the canal expansion's market impact published by the Panama Canal Authority suggest that the reduced shipping costs may shift the area of transportation cost advantage for East Coast routings from Ohio to Chicago in the North and almost to Dallas in the South.

Figure 5-2 East Coast Market Area After the Panama Canal Expansion[33]



[32] Panama Canal Expansion Impacts op cit.

[33] Source: Panama Canal Authority, reproduced from "The Panama Canal's impact on US industrial real estate" Perspectives on Global Supply Chains Jones Lang Lasalle Spring 2011 http://www.us.am.joneslanglasalle.com/ResearchLevel1/Panama_Excursion-JLL.pdf

5.3 Railway Costs and Strategic Pricing

In their final report the FMC Inquiry noted that the Port of Prince Rupert is disadvantaged by a lack of direct access to US customer destinations:

> *In fact, it has been suggested that rates through Prince Rupert are lower to offset higher transportation costs at other places in the supply chain. For example, many shippers have made infrastructure investments closer to rail facilities operated by U.S. railroads. In order to utilize Prince Rupert, the cargo must travel by rail on CN; the lower ocean rates are offered to account for the increased trucking cost to move containers from the CN railhead to the ultimate destination. As such, it is difficult to conclude that transportation costs are significantly lower when importers opt to use Prince Rupert as their seaport of choice.*[34]

They might have noted that all of the US West Coast ports find themselves in a similar situation for markets east of the BNSF and UP railheads due to the regional split between the Western and Eastern Class 1 railways. The FMC did not appear to contemplate the possibility of direct IPI shipments through interline agreements between CN and the US Class 1 railways. In fact, CN has routing protocol agreements with six Class 1 North American railways.[35]

Interline movements are used when a single railway does not have a continuous route between a shipment's origin and destination. Rail cars are transferred between railways at specified interchanges. As an example, IPI traffic from the Ports of LA and Long Beach will typically be transferred from UP or BNSF to NS or CSX in Chicago for delivery to points east. Rates are typically quoted by the originating carrier and the division of the revenue between the participating railways is negotiated on a commercial basis between participating carriers.

Based on the Leachman estimates, the incremental cost of IPI shipments to destinations east of Chicago is relatively low. For example, the incremental cost of moving a container from Chicago to Columbus is only $287. This must cover both the cost of interswitching a rail car and the linehaul costs for the 360 mile trip to Columbus. This appears low relative to actual costs; for example, the current regulated interswitching rate for similar movements in Canada based on variable cost estimates ranges from $185 to $315 based on the distance from the traffic origin to the interchange.[36]

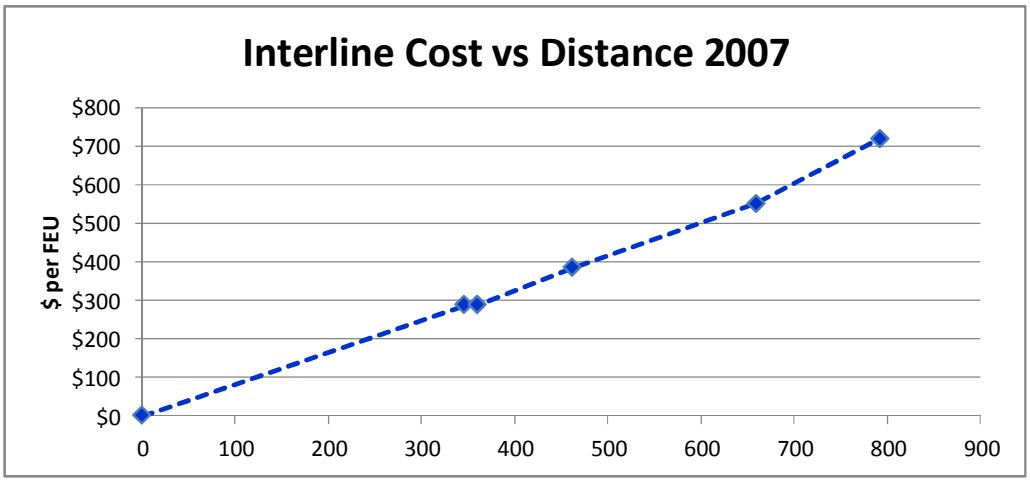
Figure 5-3 Incremental Costs Chicago to Eastern Destinations 2007

Incremental Costs Chicago to Midwest/Atlantic Destinations 2007			
Destination	**Incremental Cost**	**Distance (miles)**	**Cost per Mile**
Chicago	$0	0	n/a
Cleveland	$287	346	$0.83
Columbus	$287	360	$0.80
Pittsburgh	$383	462	$0.83
Harrisburg	$551	659	$0.84
New York	$719	792	$0.91

Based on these estimates, incremental costs for interline movements are essentially a linear function of distance. A linear regression of costs on distance returns an estimated incremental cost of $.86 per mile.

[34] FMC, p. 41.
[35] "CN and Canadian Pacific sign routing protocol to streamline flows of interline traffic" CN Press Release November 1, 2007 http://www.cn.ca/en/media-news-20071101.htm
[36] Railway Interswitching Regulations SOR/88-41 http://laws-lois.justice.gc.ca/PDF/SOR-88-41.pdf

Figure 5-4 Incremental Interline Cost vs Distance 2007



Traditionally the Eastern class 1 railways have had difficulty competing with trucking for inland shipments of containers from East Coast ports. Consequently they had an incentive to agree to a relatively low portion of the railway revenue from West Coast shipments. This was recently expressed by CSX Transportation CEO Michael Ward in an address to the North American Rail Shippers Association Conference in May 2012 when he indicated "he would prefer West Coast port growth to East Coast port expansion, because shipments from the West would less likely be diverted to trucks."[37] However, in recent years both NS and CSX have made substantial investments in their networks to reduce the costs of intermodal operations within the market region under analysis in this paper.

Norfolk Southern's Heartland Corridor is designed to improve access for intermodal traffic from the Port of Virginia to Chicago. Total cost of the project was $363 million for five separate projects:

- Central Corridor Double-Stack Clearance Project - the core of the Corridor - involves heightening clearances in 28 tunnels and associated obstructions throughout Virginia, West Virginia, and Kentucky enabling double-stack rail operations between Roanoke, VA and Columbus, OH. This shortened the trip to Chicago, by over 200 miles by obviating the need to travel via Harrisburg and then west or to Knoxville and then north. Double stack service began in 2010.
- A new intermodal facility in Prichard, WV
- A new intermodal facility in the Roanoke region of Virginia
- New state-of-the-art mega-intermodal facility at the former Rickenbacker Airport in Columbus, OH (now controlled by the Columbus Regional Airport Authority)
- Relocation of the Commonwealth Railway into the median of the Western Freeway in Portsmouth, VA, connecting to the new APM Terminal that opened in July 2007 and the future 4th marine terminal for the Virginia Port Authority.

The Heartland Corridor was also extended west to include Norfolk Southern's Columbus to Cincinnati line with aid from the American Recovery & Reinvestment Act.[38]

[37] "CSX's Ward Favors West Coast Port Growth" Journal of Commerce Bill Mongeluzzo May 24, 2012.
[38] "Project Profile Heartland Corridor: Innovative Program Delivery, Federal Highways Administration http://www.fhwa.dot.gov/ipd/project_profiles/wv_heartland.htm

In addition to the Heartland Corridor, NS is investing in 5 other high priority corridors to improve the competitiveness of their intermodal service with trucking.[39] NS reports significant cost reductions as a result of these investments:

> *… we saw significant improvement in the stacking of containers across our network. In the second quarter, 87% of all containers moved on stack cars, which was a 10-point improvement compared to the second quarter of 2011… Double stacking is the most cost-effective means of transporting both international and domestic containers. It generates the lowest cost per mile in our network for intermodal* [40]

CSX has also undertaken improvements in the region through its National Gateway Project, which will create a double-stack freight rail corridor between Mid Atlantic sea ports and the Midwest. The improvement projects are designed to increase the vertical clearances at 61 locations on CSX rail lines in the region to accommodate intermodal trains carrying double-stack intermodal containers. Construction of new intermodal terminals (the Northwest Ohio Terminal near North Baltimore, Ohio and a new terminal at Chambers, Pennsylvania) was completed in 2009. Total cost of the project is estimated at $575 million. The project is scheduled for completion by 2015, in time to take advantage of traffic opportunities from the Panama Canal expansion.

5.4 Inland Networks

Changes to the cost structure of container movements via East Coast ports could have significant implications for West Coast ports due to the dependence of the Western railways on interline movements to reach customers east of the Mississippi. The cost reductions achieved by the Eastern Class 1 railways may make them less vulnerable to diversion of intermodal traffic to trucking. This may prompt them to re-evaluate their pricing strategy with regard to interline movements of West Coast container traffic. Consequently the outcome following expansion of the Panama Canal would be dependent not just on the pricing decisions of the Western railways – which have an incentive to ensure that the largest share of traffic continues to flow through West Coast ports – but also on those of the Eastern railways which can be expected to favour whichever route maximizes their profits.

From the perspective of the Eastern railways, negotiation of an increased rate division for West Coast container traffic may be a win/win strategy:

- It would increase revenue on West Coast interline movements.

- It could drive traffic to East Coast ports for Reverse Inland Point Intermodal (RIPI) shipment via the improved intermodal rail corridors.

The ability of the Eastern railways to impose a higher rate division is subject to competitive constraints including intramodal competition (NS vs CSX) and competition from the trucking industry. NS and CSX also have to maintain commercial relationships with Western Class 1 railways for domestic interline traffic. However, if the Eastern railways increase their interline rates to the point that West Coast import

[39] Norfolk Southern –Intermodal Future Transportation Research Forum Washington, DC Chapter Roger Bennett Norfolk Southern Corp. Director Industrial Development October 20, 2010. http://www.trforum.org/chapters/washington/downloads/20101020_RogerBennett.pdf

[40] "Norfolk Southern Management Discusses Q2 2012 Results - Earnings Call Transcript" http://seekingalpha.com/article/745541-norfolk-southern-management-discusses-q2-2012-results-earnings-call-transcript?part=single

shipments are more economically moved by truck, the transhipment points at the end of the Western rail system may become a new frontier where cargo must be transferred to truck to reach its destination.

Figure 5-5 Transload Locations – High Interline Rates Scenario

Reliance on trucking for movement of West Coast container traffic to destinations east of Chicago would result in significantly higher costs. Based on the Leachman cost estimates, incremental costs for interline movements past Chicago for West Coast IPI traffic averaged $.86 per mile. Truckload rates in September 2012 were estimated at $1.77 per mile for long haul movements, and $2.42 per mile short haul (van).[41] Adjusting for trailer capacity (53 foot trailer vs TEU), estimated trucking costs are $1.11 per mile per FEU long haul, $1.51 per mile short haul. The figure below shows the Leachman Phase 2 estimates of transload costs relative to IPI direct rail shipments of 40 foot containers in 2007. These estimates are based on the cost of transloading in Southern California and shipping via 53 foot domestic containers to destination. The estimates for current costs are based on the Chicago transload differential plus the additional cost of trucking at current rates.

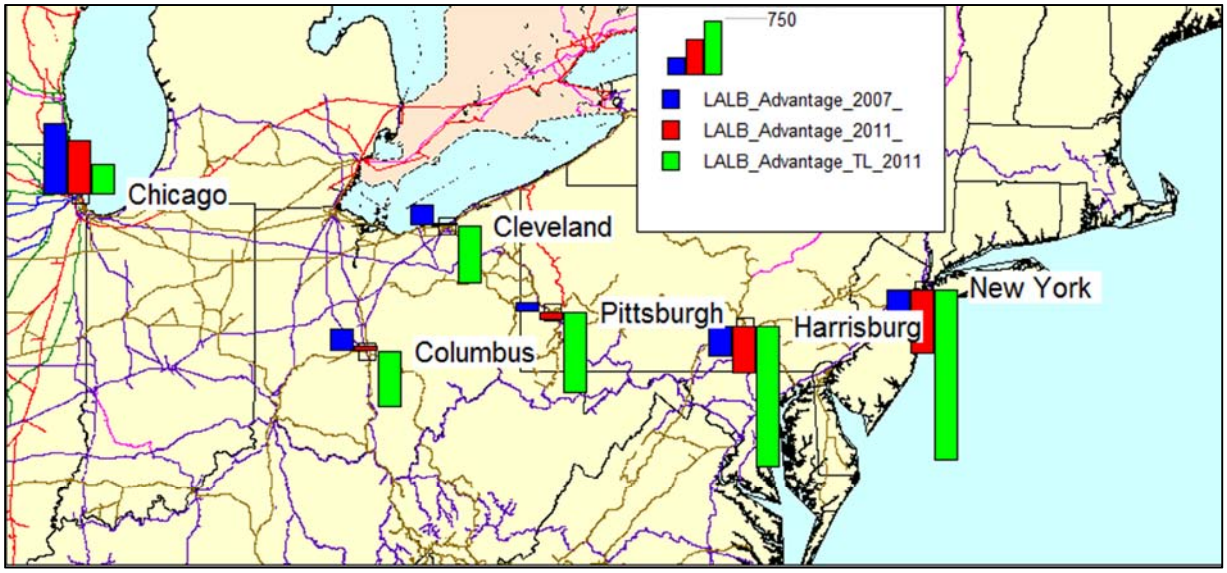
Figure 5-6 Direct Rail vs Transload Cost Estimates 2007 and 2012

Estimated Direct Rail vs Transload Costs 2007 and 2012 ($/FEU Eqivalent)						
Destination	**Port**	**Direct Rail**	**Transload Rail 53ft Container 2007**	**Transload Cost Differential 2007**	**Trucking Cost 2012**	**Transload + Trucking Cost ex Chicago 2012**
Chicago	LA/LB	$3,593	$3,832	$240	$0	$240
Cleveland	LA/LB	$3,880	$4,000	$120	$384	$624
Columbus	LA/LB	$3,880	$4,000	$120	$400	$639
Pittsburgh	LA/LB	$3,976	$4,479	$503	$513	$752
Harrisburg	LA/LB	$4,143	$4,574	$431	$731	$971
NY-NJ	LA/LB	$4,311	$4,598	$287	$879	$1,119

[41] Source: Fairtran http://www.fairtran.com/Rates.aspx

The impact on the transportation cost advantage for container shipments via the Ports of LA/Long Beach is shown below.

Figure 5-7 LA/Long Beach Transportation Cost Advantage Direct Rail vs Transload and Trucking

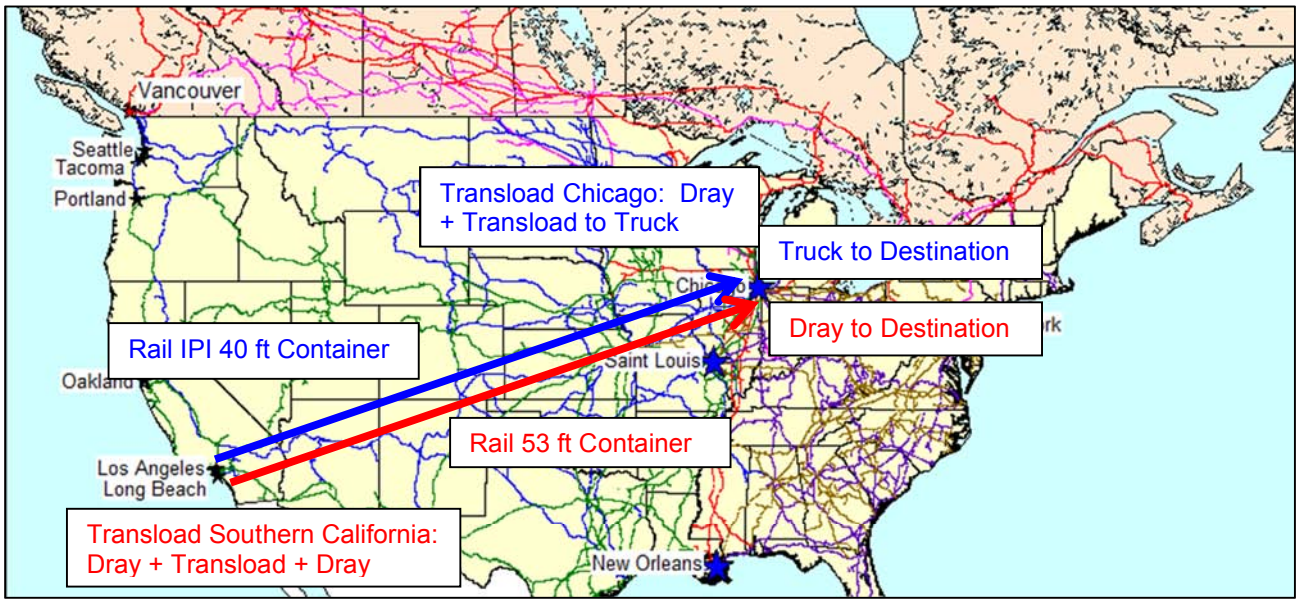


With the additional costs of transloading and trucking from Chicago, the area in which the LA/Long Beach route has a cost advantage moves inland from Cleveland and Columbus to Chicago.

5.5 Transload Options

There are two potential options for transloading cargo to Eastern destinations – transloading in Southern California and shipping via domestic container, or shipping 40 ft containers inland to Chicago (IPI) where they can be transloaded to truck.

Figure 5-8 Transload Options for West Coast Traffic



Economic factors which will influence the choice between these two options are likely to include:

- The most significant factor is likely to be rail rate differentials between 40 foot (IPI) and 53 foot containers ("domestic" intermodal). The advantage of using 53 foot containers is larger cubic capacity over 40 foot international containers (a 53 foot container has a cubic capacity which is approximately 60% greater than a standard 40 foot container) [42] which means that for "cube" freight (i.e. lighter commodities which fill a container without exceeding the allowable weight) fewer shipments are required.

An estimate of current rate differentials between IPI and domestic intermodal rates is shown below, using Columbus Ohio as an example. Domestic intermodal rates are taken from the BNSF Intermodal Advisor application on the company website for estimating potential savings for intermodal service relative to long haul trucking.[43]

Figure 5-9 BNSF Intermodal Rate Comparison (September 2012)

BNSF Domestic Intermodal Rate Comparison					
LA to Columbus Door to Door Intermodal					
	53 Ft Container[1]	**Fuel Surcharge[2]**	**Total Cost**	**FEU Equivalent**	**Transit Time**
Truck rate	$4,308			$2,693	
Standard Service	$3,185	$398	$3,583	$2,239	84-92 Hours
Expedited Service	$3,747	$468	$4,215	$2,635	64-76 Hours
Estimated IPI and Transload via Chicago					
	40 Ft Container[3]	**TSA Inland Surcharge[4]**		**FEU Equivalent**	
FMC IPI Chicago 2010	$1,220	$353		$1,573	
1. BNSF Intermodal Advisor Sept 2012. Rate includes local drayage in Los Angeles					
2. BNSF Revenue-based surcharge http://www.bnsf.com/customers/fuel-surcharge/#%23subtabs-1					
3. FMC Report					
4. TSA					

Adjusted for the higher capacity of 53 foot containers, the rate for standard domestic door to door intermodal service from Los Angeles to Columbus, Ohio is $1991 per FEU plus a fuel surcharge of $398 for a total of $2239 per FEU. The standard rate is approximately 63% higher than the 2010 IPI rate (based on the STB waybill sample) which was quoted by the FMC in their report. The comparable figure from estimates in previous sections of this paper for IPI shipment plus transloading in Chicago is $1573 per FEU. Based on these estimates, the cost of using domestic intermodal service is 42% higher than IPI plus transloading in Chicago. This assumes transload and drayage costs to the transload facility are equal in Los Angeles and Chicago.

5.6 A Reality Check

The methodology used for the Leachman studies assumes that shippers' routing choices are entirely determined by transportation and inventory costs. Practically this implies that all shippers within a given area will choose the same routing i.e. the port option with lowest costs will capture 100% of the traffic. This is clearly unrealistic for two reasons:

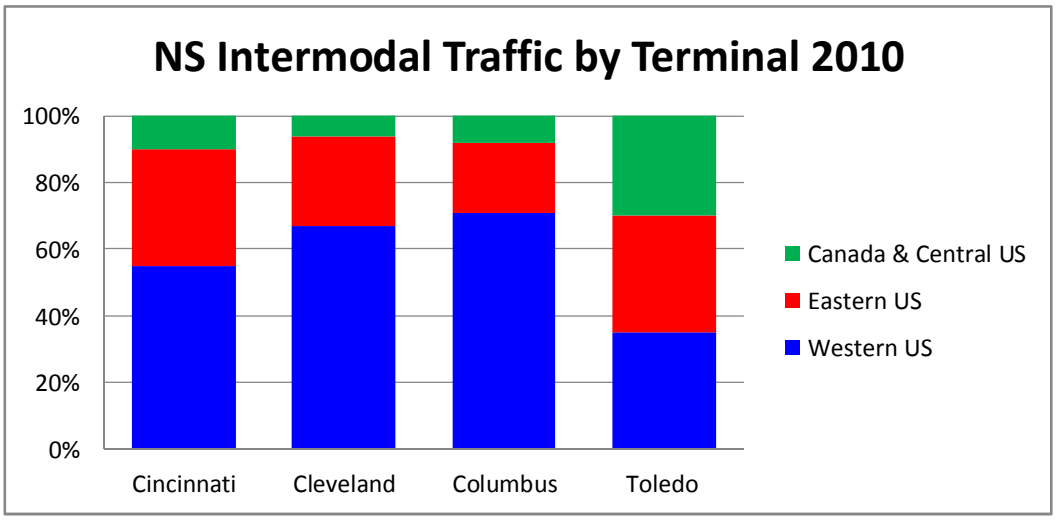
[42] Leachman 2005, p. 77.
[43] http://www.bnsf.com/bnsf.was7/pmcweb/PMCCentralController This data was extracted in September 2012.

- The Leachman studies noted that actual shippers' costs vary widely for similar shipments. The cost estimates used for estimating elasticity are calculated from averages and therefore do not necessarily accurately reflect actual shipper options; and

- There may be additional cost differentials related to warehousing, etc. which are not captured by the Leachman analysis.

It is difficult to assess actual port market shares in specific regions due to data deficiencies. A recent presentation on Norfolk Southern activity in Ohio[44] provides some insights into actual variations in port routings in a small market region. The presentation notes that Ohio accounted for 12.6% of all intermodal units handled by NS in 2010. The origin/destination regions for NS intermodal terminals are highlighted below:

Figure 5-10 Norfolk Southern Intermodal Traffic in Ohio 2010



The market share for traffic originated in or destined for the Western US (including imports through West Coast ports) varied from a low of 35% in Toledo to a high of 71% in Columbus. The variation across terminals in this relatively small market region highlights the difficulties in attempting to assess regional competitiveness on the basis of average transportation and inventory costs alone.

5.7 Conclusions

Analysts have produced a range of estimates for potential diversion of West Coast container traffic following completion of the Panama Canal expansion. However, virtually all identify the strategic pricing decisions of the Panama Canal Authority and the response of the Western Class 1 railways as a major source of uncertainty regarding the ultimate outcome. The analysis in this paper suggests that in addition to these factors, the pricing strategy of the Eastern Class 1 railways may also play a major role in determining the extent of traffic diversion from West Coast ports. If the interline rates for West Coast traffic rise significantly, US West Coast ports may face major challenges in maintaining their market share on the basis of transportation and inventory costs alone.

[44] Norfolk Southern: Creating Options for Ohio Shippers Presentation to Mid America Association of State Transportation Officials, Randy Bayles, Group Manager National Accounts, Norfolk Southern; July 20, 2011.

6 Conclusions and Strategic Implications for West Coast Ports

Port strategies have evolved substantially over the last decade. Historically West Coast ports' strategies were confined to their primary role as landlords, with the goal of maintaining low costs to attract traffic. Increasing public concern over environmental and social impacts has forced the ports to take an active role in managing environmental impacts and in investing in transportation infrastructure to mitigate community impacts and to reduce cargo delays due to congestion. Prominent examples of these initiatives include the Clean Trucks Programs implemented by the Ports of Los Angeles and Long Beach, and development of the Alameda Corridor.

From a strategic perspective, the results of the Leachman studies reinforced the involvement of ports and regional and local authorities in local transportation infrastructure investments. The high sensitivity of traffic attributed to transportation costs maintained the focus on cost control. However, the high sensitivity of traffic to cargo transit times suggested that the impact of increased costs could be offset by reductions in transit times resulting from improved transportation infrastructure. More importantly, the results were equally applicable to investment in any part of the regional transportation network – port terminals, roads, or the rail system - with transportation costs and transit times the sole criteria for investment decisions.

The analysis in this paper suggests that the elasticity of demand for Pacific Rim containerized cargo is substantially lower than conventional wisdom suggests, and that the relationship between inventory cost and port choice is also weaker than suggested in the Leachman studies. For port strategies, the results are a double-edged sword. The lower elasticity suggests that increased regional transportation costs are unlikely to have a catastrophic effect on port traffic, so targeted investments to improve efficiency may have positive benefits. However, the lower sensitivity to inventory costs suggests that improvements in transit times alone may be insufficient to offset the impact of increased costs.

The results of this research highlight the fact that the competitiveness of West Coast ports is significantly influenced by macroeconomic factors beyond the control of port authorities. It is also dependent on the strategic decisions of other service providers (including the Class 1 railways and the Panama Canal Authority). The scenario analyzed in this paper – an increase in interline rates by Eastern Class 1 railways – suggests the possibility that transloading of cargo from international marine containers to domestic containers or trucks will play an increasing role for West Coast import shipments destined east of the Mississippi River. Under this scenario, the balance between IPI and transload traffic at West Coast ports may shift. The extent of this shift may be influenced by investment decisions of port authorities and other regional stakeholder – for example, decisions between investments in on-dock rail (which facilitates IPI traffic) and development of industrial land for transloading facilities. Development of regional inland port facilities served by short haul rail shuttle operations could integrate these strategies.

Dealing with competitive challenges related to inland networks may require West Coast port authorities to expand beyond the traditional role of port infrastructure development to embrace a more active role in enhancing their competitiveness as an origin-destination routing, rather than simply as a gateway to inland networks. This would require an ability to measure and monitor competitiveness on an ongoing basis; an understanding of the factors influencing competitiveness and which of them are within the port's control, those which can be influenced by the port's strategy, and those which are entirely beyond their control; and a deeper understanding of shipper characteristics and the factors influencing their routing choices. However, they are currently ill-equipped to undertake a broader strategy due to a lack of basic information about the markets they serve.

- Ports have no reliable source of information on the final destinations of their traffic, or on the traffic routed through competing gateways.

- Ports have only fragmentary information on costs and transit times for their own traffic, and for traffic routed through competing gateways.

- Ports have little information on the service characteristics motivating shippers' choice of gateways, beyond the basic parameters of transportation costs and transit times. The Leachman estimates suggest that for major market regions the cost differentials are relatively minor among competing routes. Under these conditions, other service advantages may be decisive in influencing shippers' routing decisions. An understanding of these may be crucial in guiding strategies and infrastructure investments to improve port competitiveness.

Success will require a broader understanding of the factors affecting shippers' routing decisions than can be obtained from previous research.